Effects of variable retention harvesting on productivity and growth in wet eucalypt forests

by

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Peer-reviewed publications produced as part of this thesis:


Statement of Co-Authorship

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Paper 3, Early regeneration results following aggregated retention harvesting of wet eucalypt forests in Tasmania, Australia.

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Abstract

Society’s changing expectations for native forest management and an improved understanding of wet-forest ecology have led to the adoption of variable retention silviculture in Tasmania’s old-growth wet eucalypt forests. Variable retention aims to maintain biodiversity and ecosystem function in managed forests by retaining patches of forest or individual trees. Retained areas are intended to provide continuity of structure and function, enhance landscape connectivity, and influence the regenerating forest. However, these ecological goals must be balanced against silvicultural considerations such as achieving successful regeneration and avoiding damage to retained trees.

This study is the first to assess regeneration success and related silvicultural outcomes after operational variable retention harvesting in wet eucalypt forests, and to compare these to outcomes after conventional clearfell, burn and sow harvesting. A total of 38 aggregated retention (ARN) coupes and 31 paired clearfell, burn and sow (CBS) coupes harvested from 2003 – 2009 and regenerated from 2007 – 2010 were monitored for up to three years to address questions concerning forest influence and retention levels, the persistence of aggregates, the effects of site preparation including new ‘slow burning’ methods, and early regeneration results.

Early silvicultural outcomes after operational ARN harvesting in old-growth wet eucalypt forests were generally satisfactory, and compared favourably with outcomes after conventional CBS harvesting. There were no differences in eucalypt seedling stocking, density or height between ARN and CBS coupes at one year of age. At three years of age, seedling density and height did not vary with silvicultural system, and stocking was only 5% lower in ARN coupes when two outliers were removed. This early regeneration success in the
ARN coupes is attributed to the high proportion of burnt seedbed achieved in the regeneration burns on these coupes, the adoption of aerial sowing as a standard operating procedure, and the absence of any increase in browsing pressure or edge-related growth suppression.

Seedling height and density were strongly related to the state of the seedbed, and increased with increasing burn intensity, confirming that the creation of burnt seedbed is essential for good early regeneration in wet eucalypt forests. The higher perimeter-to-area ratio of ARN coupes resulted in a higher proportion of the harvested area being affected by firebreaks, although this decreased in more recently harvested openings due to changes in coupe design. Soil disturbance and compaction associated with firebreaks were found to affect soil physical and chemical properties and to reduce eucalypt seedling height growth by 40-60%. To reduce soil disturbance and potential impacts on regeneration, it is recommended that firebreaks be established only where absolutely necessary, and firebreak widths be minimised wherever possible.

Windthrow and harvesting damage were not significantly increased by ARN harvesting, but 2.5 times as much unharvested forest was affected by the regeneration burn in ARN coupes compared to CBS coupes, due largely to burning in the retained aggregates. It is recommended that island aggregates be at least 1 ha in size to avoid excessive burn damage and reduce windthrow risk. The longer-term effects of ARN harvesting on eucalypt productivity remain unknown, and more detailed examination of edge effects is required, but these early results indicate that initial silvicultural goals for regeneration can be met after variable retention harvesting in wet eucalypt forests.

Keywords: Australia, *Eucalyptus*, regeneration, silvicultural systems, variable retention, firebreak, seedbed.
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